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BIOLOGY CLUBS ISSUE

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Biology Clubs: A Questionnaire

PHILIP E. FOSS
Hartford Public High School, Hartford, Connecticut

The desirability of an active, enthusiastic Biology Club to supplement the activities of the biology classroom is unquestioned. To establish such a club and to insure its attractiveness often calls for ingenuity and sincere interest on the part of the sponsor. The compilation of the experiences of successful club sponsors should be of great assistance in providing new ideas for the experienced and confidence for those new to club work. The responses to a questionnaire, as set forth below, often reveal much, even in their occasional lack of agreement.

Partly in grateful recognition for their contributions, but more to encourage correspondence when further details are desired, the names and addresses of the contributors are here given:

Cynthia T. Corson, Dover High School, Dover, N. H.
Alfred J. Fortier, Foxcroft Academy, Dover-Foxcroft, Maine.
Madeline N. Herbert, 1718 15th Street, N. W., Washington, D. C.
Thelma F. Jones, 7350 Phillips Avenue, Chicago, Illinois.
Lucile S. MacColl, Thomas Jefferson High School, Pennsylvania and Dumont Avenues, Brooklyn, N. Y.
Mark McMillan, 1010 Midway, Middletown, Ohio.
O. W. Nehrer, Manchester College, North Manchester, Indiana.
Clarence M. Pruitt, College Station, Stillwater, Oklahoma.
Clifford Winnette, High School, Canonsburg, Pennsylvania.
Lee R. Yothers, Rahway Public Schools, Rahway, N. J.

Questionnaire

Qu. 1. Do you think it is better to have boys and girls together in a Biology Club, or to have a separate club for each sex?

Together.—C.T.C., M.N.H., C.M.P., L.R.Y., C.W.

My club membership is based on interest. It is on a semester basis. Officers are elected each semester.—T.F.J.

I have always had boys and girls work together in clubs, but it would depend on the project.—L.S.M.

A separate club for each sex.—M.Mc.

For groups of no more than 30, about the limit for field trips, I would not divide them. Groups much larger than this limits possibilities for seeing, hearing and participation.

Some might want to segregate for special projects, but individuals like this generally need the broader social contacts for their own good. I would rather have boys and girls together for most of the activities.—O.W.M.

Qu. 2. Do you have formal meetings with careful parliamentary procedure and fixed dates for meetings or more informal meetings as the occasion warrants and with little formality?

One formal meeting a month with careful parliamentary procedure and fixed date is necessary to give dignity to the club, but group project meetings, more informal, and other meetings when desired.—C.T.C.

Yes, we do hold a formal business meeting, after which comes our scheduled program. We try to make the business meeting short.—A.J.F.

Meetings are informal. We have a president, a vice president and a secretary-treasurer. Whatever funds we have are deposited in the School bank until needed. Parliamentary rules are observed in the election of officers.—M.N.H.

(a) As to formal meetings, not more than once or twice in a term—when we had an outside speaker or some special program. *Reason*, students prefer *doing* something.

(b) Have two kinds of clubs, one for the really capable students who will undertake projects which need a little attention every day—as breeding fruit flies, etc. The other kind of club for those who are interested but incapable of much self-direction could meet once or twice per week, but the teacher will have to exert much time, energy, ingenuity in thinking up projects and collecting material. (God help him!)—L.S.M.

About half of the meetings should definitely be at least partly formal with careful adherence to parliamentary procedure. Everyone needs and so few get too much training in this line. Each member should be able to become orderly when the occasion demands it, and conduct a business meeting.—O.W.N.

We take one all-day trip to Dunes, Brookfield Zoo or Tribune Farm each spring. We bring one big speaker with or without movies for a double period assembly each fall. We go on one spring pond trip and one all-morning trip to the Field Museum in February.—T.F.J.

One formal meeting a month. One activity meeting a month for such things as trips, arranging displays, use of the microscope.—M.Mc.

Fixed date.—C.M.P.

Fixed dates for meetings—alternate formal and informal meetings, one of each every two weeks.—C.W.

Round table discussion.—C.R.Y.

Qu. 3. Do you encourage or allow the use of school equipment such as microscopes or dissecting equipment by pupils who have left the course but who remain in the club?

Biology club has a group of students who have had a year of biology who meet when they wish and use the microscopes and microscopic equipment. Another group called the dissecting group uses school equipment under supervision as they are those who are now taking biology.—C.T.C.

We encourage the use of school equipment. Pupils who are taking biology are admitted to the Club. In a few instances we have admitted students not taking biology and who have never had a formal course in this subject.—M.N.H.

We do encourage students who have finished Biology to join clubs and use equipment.—L.S.M.

Alumni members should be encouraged to form their own clubs, to accumulate materials in which they are interested and make their contributions to the activities and interests of the High School Biology Club and to the Community. Free use of the apparatus of the school by outside individuals so often gets out of control.—O.W.N.

No.—T.F.J.

Yes.—M.Mc., A.J.F., C.M.P.

Yes, as long as the students show a proper sense of responsibility.—C.W.

Yes. Members may remain with my club three years.—L.R.Y.

Qu. 4. Do you believe in encouraging the development of projects by giving prizes or do you prefer to expect the club members to carry on their projects because of their interest in them?

I believe project completion is all the reward needed. A little praise from the teacher helps.—C.T.C.

I believe that students often have to learn that they are interested. For this reason I think some form of prize is necessary at first. As interest develops prizes can be abolished.—A.J.F.

I prefer the carrying on of projects through pupil interest. However, the science department has scheduled an exhibit of projects for this year. We may recognize su-

perior work by the award of plaques, medals, or science books.—M.N.H.

We urge students to exhibit projects in Children's Science Fair in New York. Biology Award to Seniors who are outstanding in Biology is given to the one most genuinely interested.—L.S.M.

Prizes quite often detract from the real object of the project. I much favor displays in which there is an unrecorded popular vote on which exhibit is most interesting or attractive. If some other group, the Alumni Biology Club, the Garden Club, the Audubon Club, or any other, desires to furnish rewards for projects in which they are interested and invites members from the Biology Club to participate I would gladly cooperate with both.—O.W.N.

Any way to keep up interest.—M.Mc.

Interest.—C.M.P.

Believe that students should carry on projects because of interest rather than for prizes.—C.W.

Interest and felt need for the work.—L.R.Y.

Qu. 5. Do the members make charts and museum specimens to add to the permanent equipment of the school? If so, in general how do these compare with the usual commercial projects?

Charts and museum specimens are added to the permanent equipment and are as usable as commercial products.—C.T.C.

Yes. They seem to serve the purpose as well in most cases.—A.J.F.

Yes, though some are not so well done as commercial products. I have the following which have stood up very well and are in constant use:

(a) stages in bean germination mounted on blocks in alcohol
(b) common insect friends and foes mounted in cigar boxes and Riker Mounts
(c) Collection of Mollusk Shells
(d) Charts on heredity
(e) Clay models of Protozoa.—M.N.H.

Members make plaster models and charts which compare very well with commercial products.—L.S.M.

Club members should be encouraged to make contributions to the Club. Many of these can be used in school courses. They should be satisfactory for teaching purposes, or for displays, or they are useless. However, because of local origin and construction many are of greater value to the community than any that could be purchased. The chief criterion in buying or accepting, must be their value to the Club rather than who made them or where they were made.—O.W.N.

No.—T.F.J.

Some. These are inferior to others but better to them.—M.Mc.

Yes. Favorably.—C.M.P.

Club members prepare museum specimens, etc., that are within their range of ability and experience. The preparations, at least in usefulness, compare favorably with purchased materials.—C.W.

Qu. 6. Do some of the members continue a project more than a year?

I have had none as yet, but expect to begin this year. We do hold a very successful annual Science Fair and Congress.—A.J.F.

Yes, especially those interested in taxidermy and bird study.—M.N.H.

I have not known of projects continued more than a year.—L.S.M.

It is sometimes good for some members to attempt a long project. This depends on the selection of the project and on the individual. Some cannot keep at a job a month saying nothing of one that would take a year. I would not suggest to anyone to attempt a project of this size. If someone really wanted to do it I would not refuse him the opportunity.—O.W.N.

No.—M.Mc.

Seldom.—C.M.P.

Yes.—C.T.C., C.W., L.R.Y.

Qu. 7. Are the members chosen on a basis of scholarship, or interest, or both?

Membership is open to any student who is enrolled in biology classes, or who has had a year of biology.—C.T.C.

I prefer club members with both interest and scholarship. A brilliant student not interested in biological activities is not worth much to any club.—O.W.N.

Interest only.—M.Mc.

Interest.—C.M.P., A.J.F., M.N.H., L.R.Y.

Both—with recommendations from teachers.—C.W.

Qu. 8. What proportion, would you say, of your Biology Club meeting-time is devoted to field trips?

50% field trips.—C.T.C.

Not as much as we should. About ¼ the time at present.—A.J.F.

Very little of the allotted time. However, we use Saturday mornings in the spring and fall.—M.N.H.

Not more than one or two meetings are devoted to field trips in the city, but I should do much more in a small town, especially with

a group which needed direction.—L.S.M.

For the average High School Biology Club one-half the meetings should be field trips. This might be one trip per month. In the winter they are shorter and generally more concentrated.—O.W.N.

About fifty per cent.—T.F.J.

Half.—M.Mc.

One fifth.—C.M.P.

In terms of hours, about one-tenth.—C.W.

My biology classes do 15 trips per year; Club two or three.—L.R.Y.

Qu. 9. How much publicity concerning Club affairs in the school paper, or town newspaper, do you consider advisable?

Our papers—School and Town are not interested—they have been in the past. I think publicity was helpful when they printed activities.—C.T.C.

As much as possible within reason. Let parents and friends know what the schools are doing.—A.J.F.

An article of interest in each publication of the school paper. These articles should be varied, *i.e.*, a science quiz, a story, a dramatization, etc.—M.N.H.

In our paper you can't get much publicity. Too many other claimants.—L.S.M.

The Club should do some things with news value. News items should concern the Club as a whole. It is not good for a few individuals to be too often or too much written up. Also, recourse to depending on newspaper notices concerning meetings is a poor way to keep up Club interest.—O.W.N.

All that is worth while.—M.Mc.

All real news.—C.M.P.

We make some use of both; it seems to me that such publicity is helpful to club interests.—C.W.

A worth-while club should be given much publicity.—L.R.Y.

Qu. 10. Does the Club participate in school assemblies? If so, do the members limit themselves to ideas concerning biology, or do they take part indiscriminately without particular reference to their interest in biology?

We have not as yet, but believe it is a good thing.—A.J.F.

No, but they should.—M.N.H.

We do present programs concerning Biology.—L.S.M.

If it is customary for various school groups to present the assembly program that should also be done by the Biology Club. Otherwise it should not be encouraged. Any individuals may be selected for assembly participation when they have some definite contribution to make.—O.W.N.

We show all school movies in assembly. We plant flowers around the school, etc.—T.F.J.

No.—C.T.C., M.Mc.

Yes.—C.M.P.

Yes—not limited to biology.—C.W.

Qu. 11. Are the members encouraged to join other clubs or are they expected to choose those activities in which they are most interested?

We prefer that they do not join too many clubs. They cannot do them justice.—A.J.F.

Clubs are chosen because of pupil interests. In most cases a pupil may belong to only one. Seniors are required to be members of special clubs.—M.N.H.

Members of the clubs which are carrying out a laborious project are discouraged if they wish to join other clubs. They are not serious.—L.S.M.

For the good of the student he should have more than one school or life interest. Not too many, but High School is too soon to specialize.—O.W.N.

They may join any club in school available to their class. The number of clubs is limited.—M.Mc.

Nothing said.—C.M.P.

Not encouraged to join other clubs; might load clubs with students who merely wish to belong to as many clubs as possible.—C.W.

Follow their interest.—L.R.Y.

Qu. 12. In which activities of the club do you think the majority of the members find their greatest interest?

Field trips—especially mountain climbing.—C.T.C.

Doing, rather than listening or seeing.—A.J.F.

Working on projects, field trips, occasional lectures.—M.N.H.

Dissection of frogs and small mammals or care of small animals, microscopic work, modelling things. We always have a Biology magazine which interests students.—L.S.M.

It seems that a majority of club members find their greatest interest in well-planned hikes. The Hiking Club is a live club. There are many very interesting things that cannot or should not be brought into the club room.—O.W.N.

Field trips.—T.F.J., M.Mc.

Projects.—C.M.P.

Field trips; well prepared programs; project work.—C.W.

Qu. 13. Do you place minimum and maximum limitations as to the number to be in the club? What is your opinion of a "waiting list"?

We limit our club to 25. A waiting list should be a healthy sign. I believe in it.—A.J.F.

Yes. My limit is ten. A "waiting list" is an excellent idea. Those who do not maintain interest may be dropped to make room for those who want to participate in the activities of the club.—M.N.H.

Limit self-direction clubs to 6 or 8, because we have little room. Clubs directed chiefly by teacher limited to 15–20. Good idea to have a waiting list.—L.S.M.

If the Club enrollment is not limited then the membership should be divided for a good many of the activities. This is to permit a greater number to participate. I have never had experience with the "waiting list" idea. It sounds good. These *pledges* might be invited guests at meetings and thus become increasingly interested in the Club and its work.—O.W.N.

I work out a schedule as club membership varies from year to year. I have about 30 associate members and 100 active members from my classes and the other teacher who shares my laboratory with me.—T.F.J.

No minimum or maximum limitations. If they are interested we try to make room.—M.Mc.

Fifteen to twenty.—C.M.P.

We place a maximum limit (36)—do not have a "waiting list."—C.W.

We never exceed seventeen. Don't like a waiting list. Our students may join a limited number of clubs. They should be encouraged to get into clubs instead of waiting.—L.R.Y.

Qu. 14. Where materials must be purchased for the projects of individuals, do you think it is better to pay for these from the club treasury or to expect the members to defray the cost of their own individual projects?

Individuals pay for their own material.—C.T.C.

If the cost is not too great I believe the members are usually willing to pay individually for projects for themselves. Anything the school is to keep should be paid for by the school. We try to raise money (the club) for special projects involving several members.—A.J.F.

I favor having members defray the cost of individual projects. In working on group projects certain material should be purchased with Club funds.—M.N.H.

We buy materials with funds donated to clubs from our "General Organization."—L.S.M.

In connection with members making projects we have had some success in having someone sponsor the project, advising, furnishing the material and possibly assisting in its presentation to the Club. Hiring Club members to build displays is attended with many problems.

If any member wants to volunteer something for the Club he should definitely find out what is needed, have accurate plans approved, contribute his labor, and, if the project is accepted, present all the receipts (marked paid in full) as a basis for his reimbursement. As a rule Club funds can be expended wisely in securing equipment that is professionally made or programs that can be secured in no other way.—O.W.N.

We expect the members to defray the cost of their own individual projects.—M.Mc.

Depends—individuals should pay for individual projects.—C.M.P.

Paid for from club treasury if the project is for benefit of club as a whole, other projects paid for by individual members.—C.W.

If the project is really worth while, the school should finance it.—L.R.Y.

Qu. 15. Would you be willing to suggest precautions to a teacher who is undertaking the supervision of a Biology Club for the first time?

The first meeting or two must go over big. The teacher should make every effort to see that they are well organized. There should be a definite program for the entire year. Hit or miss methods will fail. We outline our program for the year soon after school opens in the fall. The last thing in the spring we outline the first two fall programs.

By outline I mean that we decide on the nature of each meeting, omitting any names. At each meeting the president appoints, or asks for volunteers for the next meeting, the nature of which is already known. Every member is expected to appear on a program at least once during the year.

Another fact I believe many teachers do not realize is that the programs for club meetings, regardless of the kind of club, *must be rehearsed*. It is not enough to say, "at our next meeting Jane and Mary will give a talk and demonstration on making lantern slides." Jane and Mary should carefully prepare their talk, then make some slides and go through their talk, with the

club advisor for an audience, before the meeting once or twice at least. Sure, this sounds like a lot of work for the advisor, as well as the members, but,—it is a pretty good guarantee of an interesting, well-presented meeting and develops enthusiasm. Furthermore it will stimulate other members to likewise do their best.—A.J.F.

Precautions to a teacher supervising a club for the first time:

(a) Limit membership to a small number.
(b) Appoint a committee to plan a tentative program for the year.
(c) With the committee make a list of suggested projects and have members:
  (1) Select two or three for group projects.
  (2) Make choices of individual projects.
  (3) Decide what materials are needed and find out which materials are already available.
  (4) Have a definite time for meeting.
(d) Purchase and make use of "How to Organize a Science Club" published by the American Institute of Science and Engineering Clubs—60 East 42nd St., New York City.—M.N.H.

Keep them busy. Have something to do every time. Keep it lively. We make students bring note of permission from parents to join club and participate in outings.—L.S.M.

Some suggestions that might be made to a new Club leader are as follows (Local conditions may change many things but caution saves one from much grief.):

(1) Start with a small Club.
(2) Plan every activity yourself. Be sure.
(3) Pick your community help. Keep all control in the Club.
(4) Don't trade the Club to anyone in the school or community for favors.
(5) Secure a satisfactory meeting place before you have your first meeting.
(6) Publicity. Do some things that have constructive news value.
(7) If you are following some one else find out the successes or failures of your predecessor. Profit by what you find out.
(8) From the beginning emphasize the present and ultimate practical value of fair play, truthfulness, kindness and industry.
(9) The Club is for the Club members, not for the leader, nor for the community. The leader is solely for furnishing such essentials as information, guidance and inspiration.—O.W.N.

Our greatest difficulty with Biology Clubs has been to create and maintain interest sufficiently for but a few put in the extra time required for club work after school. It is our belief that members should follow their interests, and plan and run their own club with advice and suggestions from the sponsor.—M.Mc.

Concentrate on a few things—make them work.—L.R.Y.

16. Additional Comments.

This year my group in the Dunbar High School is working on plans for a flower show in the Fall of 1941. We happen to have a small greenhouse. In it have been started many plants from cuttings, tuberous rooted begonias, ferns, etc. We are learning by experience many things relative to propagation, the use of plant hormones, and the control of heat and sunlight. We hope to have several classes of entries including glass terrarium gardens, dish gardens, and window gardens for various exposures.

We are raising money this semester for prizes through the sale of our experimental efforts in the propagation of begonias, geraniums, philodendron, ivy, ferns, and coleus.

Our guide in planning this activity is "Judging the Amateur Flower Show" offered by the National Council of State Garden Clubs, Inc.

Many students come to us for advice in starting their home gardens and for building and stocking their lily ponds. We encourage gardening by taking orders for penny seed packages distributed by a local seed grower.—M.N.H.

My club is the only science club in our high school and represents all the sciences taught in our school.—C.W.

THE NATIONAL SURVEY

In this issue is concluded the last segment of the summary of results of the nationwide questionnaire study, made possible by the grant of the Carnegie Corporation to the Union of American Biological Societies. The several segments have been published during the years 1941 and 1942, beginning with Dr. Riddle's preliminary report of February, 1941. The entire summary has been published also as a single report, which may be obtained without charge from Dr. David F. Miller, Biology Building, Ohio State University, Columbus, Ohio.

The Place of the Science Club in the High School

A. N. GENTRY
Stadium High School, Tacoma, Washington

Science Clubs in the high schools are by no means a recent innovation. They have existed for a long time as nature study, astronomy, photography, and numerous other groups, depending upon the local interests of teachers and pupils. These early clubs, however, were more or less cultural in nature. The modern science club, on the other hand, must be functional. It attracts for the most part pupils who are interested in careers of forestry, radio, photography, engineering, agriculture, biological survey, fisheries, medicine, and other such occupations.

Objectives

The primary purpose of most science clubs today seems to be to give pupils an opportunity to develop vocational and avocational interests which have grown out of their regular classroom work.

Some especially active groups have broader objectives than this. The Manhattan (Kansas) Science Club, for example, last year set up and carried out a program which fulfilled the following objectives:

1. To provide an opportunity for those particularly interested in science for further study and investigation.
2. To promote science hobby interests of members.
3. To encourage school and community service.
4. To give experience in working as a part of an organized social group.

Organization

The type of organization for science clubs must of necessity vary according to the size and needs of the school. Some schools find it most satisfactory to have a club open to everyone in school; others limit the membership to science students; some allow only the best students to belong. Many science teachers prefer to let projects grow out of the classroom and have no formal club organization.

It has been my experience that a combination of the above types of organization is the most practical. To illustrate, I shall describe the plan which was in practice in the Manhattan Science Club when I taught there and which I have used in organizing the Stadium High School Science Club.

First, all students interested in carrying on some project in the science field are called together and asked to give their choice as to the particular field in which they are interested; *i.e.*, astronomy, radio, biology. Groups are then organized in the fields in which the most are interested and a chairman elected for each group. Officers are then elected for the club as a whole. This type of organization is most successful in schools large enough to have several teachers to advise the various groups.

Activities

The activities of this type of club fall into three groups: (1) Club activities, (2) Group activities, (3) Individual projects. These activities usually originate in the classroom, and individuals

are given extra credit for their projects.

Club activities include demonstrations for assembly programs and for various civic groups, social activities, and preparation of exhibits and talks for Junior Academy of Science programs. One of the most successful types of social activities for a science group is "the laboratory picnic." This is usually held in a chemistry laboratory. The members are asked to bring regular picnic food such as wieners, hamburgers, or ham and eggs. The only utensils they need to bring are skillets. The food is cooked over Bunsen burners with ring stands used to support the skillets. Scalpels can be provided instead of knives, forceps for forks, and porcelain lab. spoons or spatules for spoons. Beakers make very satisfactory glasses. Synthetic lemonade makes an appropriate drink. Enterprising students may rig up "electrocuters" for wieners. A steam sterilizer is perfect for steaming wieners and a dry heat oven can be utilized for baking such things as biscuits. This novel and entertaining activity can be wound up with a short program of science movies, talks, or, best of all, a science quiz program.

The various interest groups can carry on such projects as building a school darkroom, a telescope, a nature trail on the school grounds or in a nearby park; making collections of rocks, preserved plants, and animals, skeletons, etc., for the school museum; landscaping and caring for the school grounds; carrying on snapshot and model airplane contests; carrying on reforestation projects, and making field trips.

Most individual projects grow directly out of interests aroused in the classrooms. They are: many and varied collections, photographs, library research, building diving helmets, electrical apparatus, and radios—to mention only a few.

In this type of club, most of the work is done by the members at home. Organized meetings of groups and the club as a whole are mainly for business sessions and "pep" meetings. Occasional outside speakers may be brought in or field trips taken, but they should not become a habit. The first rule for a successful student club is participation by each member rather than constant entertainment.

Unless other funds are available, dues of 10 or 15 cents a semester may be charged to cover such expenses as Junior Academy dues, materials for school projects, and the club picture in the annual. Most individual projects are financed by the students.

The Junior Academy of Science

In order to provide an incentive for high school science club members, the Junior Academy of Science movement was begun in Illinois in 1919. More than 15 states now have Junior Academy groups, usually sponsored by the state academy of science. The Kansas Junior Academy of Science was organized in 1930 and meets at the same place as the Senior Academy. It features exhibits and talks by the member schools. Cups and medals are awarded for the outstanding talks, demonstrations, and exhibits.

A similar organization of high school and junior high school science clubs of the Puget Sound area of Washington held its first meeting in Tacoma, April 26, of last year. More than 150 students from 15 schools participated. No cups or prizes were awarded by this group, as the sponsors thought that science should be emphasized rather than the idea of winning awards. The pupils seemed to be much in favor of this plan.

A national organization known as the

American Institute Science Clubs was formed in 1938. It provides various leaflets to aid sponsors, films, radio programs, plays, programs, and suggestions for entertainments.

Conclusion

Due to the tremendous national interest in Science in the past few years, it would seem that science clubs under the leadership of active and interested sponsors should become a major factor in school activities. Science teachers should keep in mind the fact that they can interest students in anything in which they themselves are interested.

A Biology Club is Fun

ZANE LAIDLAW
Student, Post Intermediate School, Detroit, Michigan

A biology club is fun—and also educational. This is the opinion of tenth grade students at Post Intermediate School, in Detroit, Michigan, who have had the experience of one. Organized three years ago, the Post Biology Club stands as an example of an experiment that stuck. Originally including only a few members, the organization has become so popular that it has expanded to contain fifty-five tenth graders.

The club has as a primary purpose that of bringing together students interested in biology, and in the knowledge of their surroundings. It also acts as a medium through which many new friendships are made, members often discovering fellow students with interests corresponding to their own.

Meetings are held bi-weekly, and officers elected for the term from the upper half of the grade preside over sessions. Each 10A member must sponsor a 10B who makes application to the club, but he may choose his own "pledge." Probationers are required to undergo a period of initiation before they are admitted, but the process is all in good fun, and even the initiates enjoy it.

Although no dues are charged, members are asked to contribute to the expenses of any project which they may wish to undertake; this plan was voted more satisfactory than established dues. Aside from the monetary angle of membership, the Biology Club enrollment must be limited, to include a number convenient for transportation, entertainment, and refreshment. The present membership, considering these factors, is perhaps the maximum.

The club's entertainment is the problem of a student committee, who must be enterprising, and plan carefully, seizing every suitable opportunity. During the fall-winter term, programs are necessarily limited to indoor activities, and lectures, motion pictures, demonstrations, and talks by members are the order of the meetings in this period. If a member's father is a doctor or dentist, the entertainment committee interviews him, and asks him to speak to the Biology Club—usually with excellent results. Johnny Jones visited Yellowstone Park last summer—will he tell the club about points of interest on his trip? He will; and Yellowstone Park is brought nearer to members who have not visited it when they hear a friend tell about it, in his own way. Mary Smith has recently read a book which would probably

be interesting to club members; she presents a review of it, bringing out points which appeal to the prospective reader.

With the advent of spring, however, activities take a different form. As much time as possible is spent out-of-doors, on hikes, field trips, picnics, and week-end visits. The members decide places which they would like to visit, and, if possible, arrangements are made to visit them. For places too far to hike, buses are chartered, or obliging parents lend their cars. Contact with surroundings is welcomed by students in a large city; on a single tramp through the woods, or in the examination of a single pond, most members discover new facts of which they had never before heard.

Although the Biology Club is, first of all, a student organization, it has greatly benefited the school. Each term, the departing club members contribute a small amount to a gift fund, which is used to purchase a suitable present for the school: a microscope, new laboratory equipment, shrubs or flowers for the garden. The Club each term gives a performance for the whole school, emphasizing subjects of interest to the whole student body. These may include bacteriology in everyday life, conservation, health, or biographical sketches of famous scientists.

This organization has given many students a greater understanding of the world out-of-doors and the plants and animals it contains, of the influence of science on their own lives, and of the future of biology; and, with that understanding, who will not agree that the boys and girls have a better knowledge of the world in which they must some day take places as citizens?

EDITORIAL COMMENT

At this time it seems to be in order that your new editor make a brief statement. I can do no better than repeat what your first editor, I. A. Herskowitz, said in Volume I, Number 1, October, 1938: "The splendid cooperation of our members and friends has confirmed our expectations that The National Association of Biology Teachers and its periodical THE AMERICAN BIOLOGY TEACHER would be received with an enthusiastic welcome. More than ever before we have the utmost confidence that our objectives will be realized. With your assistance we gladly face our job of serving the needs of biology teachers and biology teaching everywhere."

No changes in policies or broad plans are in view at the present time. My hope is that our journal will remain on the same high level of true professional merit which it has enjoyed in the hands of its former editors. It may be worth reminding ourselves that any institution can be successful only when many people help.

The maintenance of a high standard of quality of published material requires a constant flow of manuscripts from which to make selection. This is a field in which any interested member can cooperate. You do not have to prepare a lengthy or profound article—you may contribute a teaching aid that you have found useful in your own classroom, a visual-education device that may not have occurred to others, an idea for a pupil activity project or a biology club program, a news note that may be of interest of value to our readers, a laboratory substitute (these will become increasingly important in the coming days of priorities and rationing), a practical application to national defense or to post-war reconstruction, or anything else that you think may help some other teacher to make his course more useful, practical or interesting.

A considerable part of the success of such an enterprise as our journal depends on the support of its advertisers. This is another field in which many of the readers can give some assistance. Make yourselves familiar with the products that our advertisers have to offer, mention THE AMERICAN BIOLOGY TEACHER when answering advertisements, and notify the managing editor of any new advertising possibilities of which you may happen to know.

Life science can serve the nation in many ways—there is not room here to develop this point, but it has been discussed in our columns several times—but only if it gets to the people. It can do no good when it exists only in the research laboratory or in the notebooks of the biologists. It is the teachers, chiefly those on the secondary school level, who have the privilege and responsibility of bringing to the people those phases of biological science which can be of greatest value to them.

Our role in the national emergency is not yet entirely clear, but it is evident that all-out participation of our own country in the war brings challenges of all sorts to the teachers. For teachers of biology these challenges have to do with nutrition, health, physical fitness, wise use of food and other resources, post-war plans and the like.

WHAT A BIOLOGY CLUB CAN DO

A Biology Club is composed of a group of young people who are interested in Biology and a Sponsor who is interested in young people. In discussing what can be done by this very excellent association, it is difficult to state which plays the more important part. Achievement,

surely, is the aim of the group, but the dynamic force behind it all is the Sponsor. It has been the writer's experience that students will attempt most anything and surmount any obstacle which stands in the way, if proper motivation is provided.

It is essential, however, in the very beginning, to impress upon the club members that everything concerned here belongs to them—even the Sponsor. This means that they will always assume full responsibility at the meetings and consider the Sponsor as necessary as the president. It then devolves upon the officers to see that the Sponsor is present at their meetings for the inspiration of the group and at their social functions or trips as their guest. Sometimes one is obliged to stress this viewpoint but however difficult this may be, the results are well worth the effort and a good leader is sure to be successful. More can be done in this regard by private conferences with the officers than in talks to the entire group.

With this attitude established, the work of the sponsor is simple. With due consideration for student initiative, he plans, with the president, a semester's work. This will need to be arranged in accordance with the semester's class work if the Club is to supplement the course and, since textbooks differ in their treatment of Biological material, only very general suggestions can be given here. Some projects which have been worked out in a Biology Club are:

Skeletons: cat, rat, frog, pigeon, chicken, duck, bat, bird, mole.

Models: amoeba, paramoecium, earthworm, hydra, mitotic figures, frog development, development of egg to gastrula stage, development of female gametophyte, flower parts, cross section of tooth.

Charts: Diagrams, life cycles of plants, nitrogen cycle, life cycles of malarial parasite, liver fluke, etc.; original charts illustrating some interesting biological situation.

Collections: Insects, leaves, weeds, seeds showing means of dispersal, fungi, cacti, tadpoles in various stages of development, fossils.

Lantern slides: These may be made from film strips, from positives made from photographic negatives, from color films, by mounting such things as insect wings, moth antennae, insect legs, fish scales, bits of small plants such as selaginella; by drawings on ground glass with colored pencils.

Experiments: These are perhaps the most important if the Science club is to encourage research. Nutrition experiments with white rats; soil free gardens; Study development of chick embryo; Study ability to learn in various small animals; Study of insect pests; verifying statements found in text-books.

Field trips: Places of biological interest in one's own city; State University if not too far; lakes or rivers in the vicinity, etc. It is well to appoint two members to act as scouts for the club. They will visit places of interest and report to the club what may be seen there; how to get there, etc. Then the members decide whether or not they wish to go.

Exhibits: Students always find it very interesting to display their finished projects. This can be done in an assembly of the high school or to parents and friends.

Affiliation: The American Institute Science and Engineering Clubs offer very attractive service to member clubs and the Junior Academy of Science gives club members an opportunity to meet young scientists and to exchange ideas.

Publication: A local club paper is interesting and beneficial and may lead to contributions to such publications as *The Science Observer* and *The Science Leaflet.*

Interclub activities: Biology Clubs in the different high schools of a city or nearby cities may plan a science congress or fair thus bringing young people interested in science together.

Broadcasting: Interesting talks on Biological subjects are being broadcast by club members. When this is done the audience consists of all clubs in the vicinity.

Sister M. Etienne,
Mt. Mercy Junior College,
Cedar Rapids, Iowa.

Scientists' Comments on Science Club Projects

LOIS M. HUTCHINGS
Weequahic High School, Newark, New Jersey

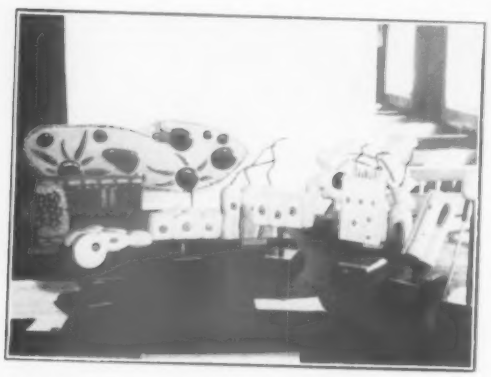
At the Marine Biological Laboratory, Woods Hole, Massachusetts, some four hundred scientists, research associates and students congregate every summer to study salt water biology. Included in their number are many of the most outstanding American zoologists, embryologists, botanists, and physiologists. Upon finding that many of the scientists were unaware of the project work which goes on in high school clubs and in certain progressive schools, I obtained permission to exhibit selected projects in the Old Lecture Hall of the laboratory sometime during the summer of 1937. The scientists were invited to inspect the exhibit at their leisure during a certain week of July, and were especially urged to leave written comments and criticisms. About three hundred and fifteen people

Photography. No one of 315 people had anything but praise for this Leica camera photography. There are two classes in photography at this high school. Perth Amboy, N. J.

visited the exhibit and one hundred and seven offered comments.

Desirable as it would have been to have included projects representing all sections of the country, a lack of time, of money, and, especially, a lack of knowledge of organized groups precluded this. Actually, the projects were assembled from the best of the 1937 New York Science Fair and the New Jersey Science Fair. It is regretted that an oversight prevented material from the Peabody House Science Fair in Boston from reaching the exhibit.

A limitation which could not be avoided was the selection of only such projects as could be shipped without injury to them. Living animals, woodland plants, attractive bits of natural habitat—marsh, wood, meadow—such as one finds exhibited at the Science Fairs, and similar projects had to be eliminated. I was particularly disappointed to learn that a fine ecological project, displaying insect and small animal life which one might find within a foot above and below the earth's surface, had slipped from a truck as it was being reshipped to a high school from the Science Fair. Thus, one hope was literally dashed to pieces.



Models—Paramecium, etc. Models carved from wood. The leaf cross-section is an especially fine piece of work. Is such work beneficial to a school? Is the amount of time involved justified? Rahway, N. J.

Descriptions of Projects Exhibited

If you will glance at the illustrations accompanying this article you will see something of the range of material it was possible to show. Twenty magnificent photographs of enlarged tree buds, seed capsules, insects, and plant shoots did much to relieve the bare, barn-like appearance of the hall. There were two tables of biological equipment which had been carved from wood, chiefly the work of one boy. He had done a series of prehistoric animals, prehistoric men, models of protozoa, models of types of cells and of gland types, a cross-section of a leaf (think of carving each chloroplast!) and the crowning work—five models tracing the reduction in bones of the horse's hoof. The last project was a means of expressing appreciation to his biology teacher for bailing him out of jail after a speeding jaunt.

Evolution of the Horse's Hoof. Wood carving. Isn't this superb?

By chance, there were three sets of mitosis models—one carved from wood and a series whose cell walls were of fragile balsa wood (necessitating skillful use of Scotch tape), nuclei of half rubber balls and plasticene, spindles of wire and chromatin of beads. The fact that the youth had included asters in cells purporting to be those of higher plants did not escape the eyes of the botanists.

Twinning. Note the actual two-headed fish in jars. Is the type of cleavage shown characteristic of fish? Is the exhibit effectively mounted? New York City.

Embryology was represented by two exhibits. There was the double-monster exhibit which high-lighted the technique of constricting an embryo between its blastomeres in the two-cell stage, and a set of beeswax-paraffin models of the embryology of the frog. The latter was accompanied by photographs of the method of securing pituitary glands to inject into females, thereby inducing ovulation.

There was a nicely-mounted exhibit showing the method of making microscopic slides. The sides of the case were made attractive by photomicrographs which the young science enthusiast had taken with home-made equipment. (As you know, respectable results may be secured with a dollar camera and a school microscope. Lighting may be reenforced by a photoflood bulb in a coffee-can reflector.)

On one table was a collection of simple projects which had been submitted as part of the term's work in a regular biology class. These ranged from the plaster cast of a fish, through a set of apparatus for testing the heat given off by germinating seeds, to a set of colored light filters for use with a microscope, and a habitat study of the ant-lion larva.

There was a single exhibit dealing with comparative anatomy—that of vertebrate hearts. On the beef heart alone, the boy had spent three months of study, working out a system for designating each blood vessel and each part by means of colored-topped pins. To obtain a

Comparative Anatomy of the Heart. Are the dissections adequately explained? Are the diagrams of hearts used in the background adequate? Newark, N. J.

heart of a bird (chicken) with sufficiently long blood vessels, he had dissected and rejected fourteen specimens before securing one to meet his standards.

The joy of the small boys who frequently wandered in and out of the exhibit hall was a model which showed the parts of the nervous system traversed successively by the nerve impulse initiated by a pin-prick. One-sixth turn of the crank brought a wooden finger in contact with a sharp-pointed nail (the pin). Another-sixth turn caused the lighting of a small sign which revealed that the impulse was travelling up an afferent nerve toward the spinal cord. Nerves were constructed of wire and their sheathing consisted of medicine powder capsules, an arrangement which simulated nodes quite effectively. The impulse was completely traced by lighted signs to and through the spinal cord from one type of cell to another and conveyed to a muscle whose contraction (by a spring) removed the finger from the nail.

The project which drew the largest share of cheers, after the photography, was the model of a kymograph. This device consists of a metal cylinder, about the size of an oatmeal box, which must be made to revolve slowly in some fashion, and around whose circumference a piece of paper blackened with smoke is fastened. A pointed instrument attached to a muscle traces a record of the muscular contractions upon the smoke-blackened paper. To make the record permanent it is necessary only to dip the paper in a thin white shellac and allow to dry. The constructor of our kymograph was a girl, who had found that a broken alarm clock would turn her cylinder at the proper rate of speed. In the illustration, the Tinker Toy supports for the cylinder may be seen. She had used the apparatus to compare the effect of aspirin, caffein and strychnine upon frog (animal) muscle, and her records were most carefully scrutinized by the physiologists; of which, more anon.

Kymograph. Made by a girl from a clock motor, a lemon squeezer, and Tinker-toy parts. It worked. Do girls possess originality? The judges thought so. Bronx, N. Y.

Sponsors of the Exhibit

While I deplore the conditions which prevented the displaying of a completely well-rounded exhibit of the many phases of plant and animal study which are undertaken in our laboratories and classrooms, no further apologies are offered. The exhibit had the backing of the director of the Marine Biological Laboratory, of the American Institute of New York City which coordinates the work of science clubs of New York State and adjoining states, of Mr. Harry B. Weiss, who initiated the New Jersey Science Fair, of Dr. Wilford M. Aikin of the Progressive Education Association, of Mr. H. Harry Platt, at that time Science Director of the Peabody House in Boston, and of Dr. Otis W. Caldwell, who promotes the Junior Academies of the American Association for the Advancement of Science.

Appreciations of a General Nature

Reactions to the projects were soon forthcoming. While unpacking an exhibit in a hidden corner I heard two foreign scientists (fellows of the Rockefeller Foundation) say, "If every kid could do some of this there would be less trouble in the world."

"Yes, indeed! Isn't the photography marvellous?"

"It would be perfect for book illustrations," agreed the first speaker.

Dr. Leo Loeb, emeritus professor of pathology of Washington Medical School, whose office was above the exhibit, left this note of appreciation: "I am deeply impressed by the scientific spirit, technique and artistic accomplishment shown in this display of high school projects." Another medical school professor admitted that it reminded him of the "intellectual enthusiasm" for the study of biology which he had received in his own high school days.

Many were impressed by the maturity of the work of secondary school students. In fact, one University of Illinois instructor wrote, "These exhibits show an understanding of biology which would be pleasantly surprising in many college freshmen finishing a beginning college course." A slight exaggeration, but Dr. Hiestand of Purdue University went a little farther in wishing that college students could see the exhibit "to profit by these examples."

Fostering of Originality and Ingenuity

One of the most frequent comments which it was a pleasure to read or hear concerned the ingenuity and originality shown by students. Many a learned man was surprised that a girl had the mechanical ability to construct a kymograph. One visting professor of physiology, who had used this instrument hundreds of times, enjoyed such a hearty laugh over Francine's perky substitute for expensive apparatus! "Isn't that ingenious? We don't very often think of a girl's doing anything like that," his companion remarked. One investigator seemed to put her finger on the heart of the matter when she wrote, "The stimulation of the secondary school youngster to creative work is highly important." Too seldom do we feel that the curriculum allows adequate time for creativity to take place in our classes. Nor are we often sufficiently free from clerical details to run about and gather the raw material of project work for *all* of the pupils. Since the parents of youngsters are unwilling for them to travel far to find their supplies, this responsibility is thrown back onto the teacher. Creativity does not take place in a vacuum, nor are its media those airy generalizations of arm-chair educators. The spark of stimulation ordinarily must be supplemented by a suggestive material left in a strategic spot. However, many of us who recognize this need of youngsters salve our consciences by encouraging individual projects occasionally, or do so through work with a club group. In a club, we may let them "learn by doing," which Dr. C. E. McClung, author of *Handbook of Microscopical Technique*, assured me was the only way of learning.

Encouragement of Scholarship

A value which was deemed highly important by those closely identified with learning experiences (college students and instructors) was the thorough understanding of a subject which a pupil gains through project work. To construct requires complete visualization of the finished product. To experiment re-

quires a clear-cut purpose and well-conceived methods. Inevitably, the student is thrown back upon reference reading to clarify his ideas before the details of the project can be planned. Idea must be matched with idea and adaptations made in view of a student's own limitations of knowledge, equipment and materials. Questions from interested onlookers force him to think about points previously unconsidered. Intellectual growth is unavoidable. It is no wonder we find that students who carry a difficult project to completion tend to have an unusual grasp of the phase of biology investigated.

Value of a Goal

An inevitable outcome of an especially fine "piece of work demanding patience and exactness" is that such a student sets a standard to which "his fellow students may aspire." A club sponsor finds that the quality of projects improves from year to year, within reasonable limits. Even the proofs of individual ability offered by candidates for admission to the club seem to be better year by year. A Canadian biology teacher expressed his appraisal of the projects in this way: "The entire exhibit was a revelation to me of what really can be done by youngsters with a goal to reach. I'll take many ideas home with me and try to put some of them into effect in my own classroom. Thanks a whole lot."

Inexpensiveness

Lest anyone reading this article be frightened by the apparent expense involved let me assure you that it need not be great. My own club of twenty members was forced to operate on a budget of $2.50 a term, plus their own contributions. Often the student paid half and the club treasury furnished half of the money. Dr. S. C. T. Hsiao of China was cognizant of the relative inexpensiveness of project work as one of its merits. He wrote: "I am very much impressed by the ingenuity of the model of the reflex act and of the kymograph, which are made of very cheap and ordinary materials that can be secured in any school. It takes a bright mind to put them together to serve a useful purpose."

Ability to Use One's Hands

That leads us to consider a value of project work in biology which undoubtedly can be overdone, as many pointed out. Let us consider its positive aspects first.

"The making of models, charts, etc., provides a channel of expression for the student who leans to the practical side of education. It seems to me that this type of work will do a great deal toward developing hobbies that seem so necessary with shorter working hours and more leisure time. For those who will enter scientific careers a knowledge of how to use their hands and simple tools will be a valuable asset. Not all of the present university students can do the simplest kinds of apparatus building. The reappearance of hobbies will lead to advancement of knowledge as well as yielding personal satisfaction as occurred in the past century. I believe our schools might well extend the work your exhibit demonstrates."—Dr. O. W. Richards, Yale University, and Technical Adviser, Spencer Lens Company.

(To be continued)

Tell your friends about the *National Defense Issue*, which appears next month, and have them make use of the blank at the end of page 192.

YOUTH AND THE FUTURE

The American Youth Commission, appointed in 1935 by the American Council on Education and financed by The General Education Board, has just published its findings and recommendations, under the title *Youth and the Future*.

This publication represents an important step in the long range planning necessary for an accurate consideration of the problems of youth both in relation to the present national emergency and the post-war reconstruction period. It should be of interest to teachers everywhere. Biology teachers will be most interested in the chapters on *Use of Leisure Time*, *Marriage and the Home*, and *Health and Fitness*.

As long as the supply lasts, the digest of *Youth and the Future*, prepared by the Commission, is available to readers of THE AMERICAN BIOLOGY TEACHER. They may be obtained free from Mr. W. M. Southworth, Jr., Executive Assistant, American Youth Commission, 744 Jackson Place, Washington, D. C.

A LETTER FROM OHIO

Dear Mr. Houdek:

Enclosed find one dollar for a year's subscription and my membership dues to the National Association of Biology Teachers.

Sometime ago you sent me an outline and plans for a biology class room. I wish to say that I used the plans as presented by J. Roy Byerley in THE AMERICAN BIOLOGY TEACHER Oct. 1938. In trying to get my plans passed by the Board of Education, I found that your magazine carried great weight as an authority in its field and the adoption of the plans were accepted without any question.

I now have a fine biology class room that can be used for either class recitations or laboratory work. No time is lost in changing from a recitation period to laboratory work because of the arrangement of equipment and reference material.

The plan suggested in THE AMERICAN BIOLOGY TEACHER is certainly ideal. With slight modifications to fit individual cases this plan should be adaptable to nearly any high school room or rooms.

Thank you for helping me obtain a fine biology room.

Sincerely yours,

AARON H. KELKER
Chillicothe High School
Chillicothe, Ohio

NEW COURSE IN VERTEBRATE ZOOLOGY

Beginning February 7, the New York Zoological Society offers for the first time an accredited course in Vertebrate Zoology for adults, according to Fairfield Osborn, President of the Society. The new course is designed primarily for teachers in the public school system, but may also be taken by Scout leaders, librarians, or any interested person over 18 years of age. The sessions include a survey of the various aspects of animal life on exhibition at the Bronx Zoo. Members of the scientific and curatorial staff participate in the series of ten lectures and two field trips, using live animals as demonstrations in topics on birds, mammals, reptiles and fishes.

SOUTHERN CALIFORNIA ASSOCIATION OF LIFE SCIENCE TEACHERS

At a recent meeting of the Life Science Association of Southern California, the following officers were elected:

President: Mrs. Lilla Armstrong, Lincoln High School, Los Angeles.

Vice President: Mr. John L. Arnold, University High School, Los Angeles.

Recording Secretary: Mrs. Leigh M. Dodson, Los Angeles City College.

Corresponding Secretary: Mrs. Lucile W. Neuswanger, Los Angeles High School.

Treasurer: Mr. Lee Haines, Jordan High School, Los Angeles.

During the fall semester, two outstanding programs were given under the auspices of the Association. The first was a trip through the biology laboratories of the California Institute of Technology. The visitors were shown the research equipment used in the analysis and synthesis of vitamins, the quantitative measurement of vitamin content, the growth of plants under varying conditions of light and nutrition and the studies in heredity on the fruit fly. The second program consisted of an illustrated lecture by Dr. Clifford A. Wright, internationally known for his work on endocrine glands.

MR. A. N. GENTRY, author of "The Place of the Science Club in the High School," page 171 of this issue, is at present working toward his doctorate at the University of California and teaching part time in Williams College, Berkeley, California.

THE COOPERATIVE COMMITTEE ON SCIENCE TEACHING

Under the sponsorship of five scientific societies representing Biology, Chemistry, Mathematics, Physics, and Research in Science Teaching a committee has been formed to work on educational problems of vital interest to all science teachers, which no single organization can solve working alone. The committe is known as the Cooperative Committee on Science Teaching.

Two meetings have been held, one in April and one in November, 1941. Work is now in progress on four problems:

1. Licensing or certification of secondary-school science teachers. The committee hopes to work out a solution that will be practicable, and that will be adopted by certification authorities.

2. The college training of prospective science teachers. It is desirable to prepare teachers for certain teaching combinations of subjects rather than to prepare intensively in one subject.

3. Exploratory studies of the secondary-school science curriculum. The committee hopes to stimulate a number of colleges and universities to organize workshops and conferences for bringing together secondary-school teachers to work on their educational problems.

4. Problems of state or local agencies needing the services of educational consultants on questions pertaining to science teaching. The committee offers its services as a consultant to state or local agencies working on problems pertaining to science teaching.

The committee consists of the following members:

Representing the American Association of Physics Teachers
K. Lark-Horovitz, Purdue University
Glen W. Warner, Wilson Junior College, Chicago

Representing the American Chemical Society
B. S. Hopkins, University of Illinois
Martin V. McGill, Lorain High School, Lorain, Ohio

Representing the Mathematical Association of America
A. A. Bennett, Brown University
Raleigh Schorling, University of Michigan

Representing the National Association for Research in Science Teaching
G. P. Cahoon, Ohio State University
Robert J. Havighurst, University of Chicago

Representing the Union of Biological Societies
Oscar Riddle, Carnegie Station for Experimental Evolution

Robert J. Havighurst is Chairman of the Committee and Glen W. Warner is Secretary.

Amount and Nature of Biology Teaching in Secondary Schools: Data from a Questionnaire

DR. OSCAR RIDDLE
Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, N. Y.

(Continued from February)

Extent to which sex education is taught in biology and other classes. Though teachers were asked to give data concerning the classes (subjects) in which "sex education is a definite goal of instruction," many of them drew a line through the word "definite" and substituted "incidental." Thus the data shown in Table 9 distinguishes only between schools or classes in which sex education is or is not taught. In some schools this topic is taught in more

than one department of instruction, and some replies clearly did not answer all parts of this question. Almost exactly one-third (958) of the 2,900 replies state that the topic is not taught. In New England and Southern states the topic is taught only slightly more often than it is omitted, while in Western states it is taught in approximately 75% of the schools. It is evident that the classes in general biology are most utilized for the teaching of sex education. Classes in hygiene and physiology are thus utilized in far fewer cases; but since relatively few high schools offer courses in these subjects (see segment of report written by Dr. Miller) it is obvious that when such courses are offered they are used even more extensively than is biology as media for sex education. Neither general science nor zoology was specifically mentioned in the questionnaire, and those subjects as well as others are here included under "another department of instruction."

Teaching and not teaching organic evolution. The question on this subject was so subdivided (A to F of Table 10) as to facilitate the quick recording of fairly accurate information with a single check mark. It may be noted, however, that 108 (3.4%) of the teachers who returned questionnaires (3,183) failed to check any item or subdivision of this question. This failure applied to 3.2% of teachers in the public, 9.9% of the parochial, and 3.9% of the private schools. Perhaps more notable is the fact that replies were received from 3,075 teachers and that they represented 96.6% of the total sample.

Further analysis of the data shown in Table 10 is complicated by the fact that 567 duplicate (or triplicate) entries were made, *i.e.*, items C and D, or items C, F and G (etc.) were checked by one and the same teacher. Categories C and D might, if not notably qualified, suggest an adequate orientation of the little or much consideration given the subject and it has seemed necessary therefore to learn the number of duplications which involve C and D, and also the number of times either of those items (C or D) was combined with G.

This analysis shows 227 duplications of C and D among teachers from public, 1 from parochial and 11 from private schools; the total is thus 239. An additional group of 64 teachers from public schools and 1 from a private school (total of 65) noted that though they checked C and D, their teaching was "by inference only" (G). Finally, 1 (public) who checked C ("taught as a fact") also checked E ("taught as having application to sub-human organisms only"). When the 305 included in these three groups are deducted from the sum of C and D one obtains an indication that 1,651 teachers teach evolution either "as a fact" or "as the principle underlying plant, animal and human origin." This is 53.7% of those who replied (3.4% did not reply) to this question. There is a presumption that most of those who failed to reply viewed the question unfavorably and were unprepared to check either C or D. Moreover, in their replies to the next following question (see below) a considerable number of those who checked item C showed by their voluntary comment ("other reasons") that to them "taught as a fact" does "not include human beings," that "theistic evolution" (or according to St. Thomas Aquinas) is implied, etc. This comment does not permit a decision as to an exact or definite number who, in the usual sense of the word *evolution*, are thus found to be wrongly classed by their checks under item C; but this number

TABLE 9

Amount and allocation of instruction in sex education in high schools

Region	Public							Parochial				Private						
	Taught in						Not taught	Taught in			Not taught	Taught in						Not taught
	General biology	Physiology	Hygiene	Botany	Another department	To mixed groups		Various biological	Another department	To mixed groups		General biology	Physiology	Hygiene	Botany	Another department	To mixed groups	
Total U. S.	1,095	192	437	42	264	638	889	23	22	7	33	84	20	22	2	25	12	36
New England	44	3	8	3	7	18	67					24	5	2	1	4	1	10
Mid. Atlantic	241	19	156	8	51	154	201	7	9		6	21	1	7		7	4	14
Southern	122	18	29	5	26	82	129	2	2	3	2	7	1	2		2	2	1
Central	517	94	172	19	118	270	410	11	8	4	25	25	11	10	1	9	5	8
Western	171	58	72	7	62	114	82	3	3			7	2	1		3		3
Sp. large cities	71	19	49	5	9	34	81											
All large cities	167	64	99	12	50	100	157											
Small cities	235	43	100	15	61	150	168											
Towns	335	38	113	7	60	196	215											
Rural	358	47	125	8	93	192	349											

probably exceeds 60. In the present sample of biology teachers in high schools of the United States it is therefore evident that only approximately 50% teach the principle of evolution either as a fact or as the principle underlying plant, animal and human development.

Four elements of the data of Table 10 (and of earlier parts of this Report) indicate moreover that the present sample of schools gives a more favorable account for the teaching of evolution than would be found in a complete sample for the country. (1) The parochial schools are perhaps least adequately represented in the present sample and here they are recorded to the lowest extent in items C and D. (2) The teachers of Southern states are poorly represented

TABLE 10

Instruction and lack of instruction on the subject of evolution

Region	Type of school	Replies		"In my school the subject of evolution is"							
		Number	Per cent	Entirely omitted	Openly denied	Taught as a fact	Taught as principle underlying plant, animal and human origin	Taught as having application to sub-human organisms only	Taught as scientific hypothesis	Taught by inference only	Reply omitted
				A	B	C	D	E	F	G	
Total U. S.	Public	2,808	96.8	109	15	458	1,374	79	892	418	92*
	Parochial	90	90.9	4	5	8	6	14	40	12	9
	Private	177	96.1	5	7	31	79	9	64	13	7
	Totals	3,075	96.6	118	27	497	1,459	102	996	443	108
New England	Public	150	.....	7	.....	16	73	5	60	17	5
	Parochial	1	.....	.....	.....	.....	.....	.....	1	.....	.....
	Private	43	.....	1	1	14	26	.....	12	2	.....
Mid. Atlantic	Public	648	.....	16	5	95	368	14	185	80	19*
	Parochial	24	.....	1	1	4	1	6	14	.....	2
	Private	48	.....	.....	2	6	24	3	16	3	3
Southern	Public	355	.....	43	3	48	94	22	111	66	8
	Parochial	8	.....	.....	1	2	.....	2	3	2	.....
	Private	11	.....	.....	1	1	5	1	5	.....	.....
Central	Public	1,297	.....	37	5	235	635	35	419	204	46
	Parochial	49	.....	3	1	2	4	4	20	10	7
	Private	59	.....	4	3	7	15	3	27	8	4
Western	Public	358	.....	6	2	64	204	3	117	51	14
	Parochial	8	.....	.....	2	.....	1	2	2	.....	.....
	Private	16	.....	.....	.....	3	9	2	4	.....	.....
Sp. large cities	Public	233	94.0	4	.....	66	155	2	77	19	15
All large cities	Public	538	96.9	19	1	124	296	9	158	72	17
Small cities	Public	565	98.3	15	1	80	346	16	191	82	10
Towns	Public	735	96.6	27	4	113	353	18	226	100	26
Rural	Public	970	96.1	48	9	141	379	36	317	164	39*

* Does not include 3 "unclassified" schools which merely reported "no biology taught."

in the present sample, and of all regions it is most poorly represented in items C and D. (3) The method of mailing this questionnaire assured its receipt predominantly in the better high schools, in those thought most likely to purchase biological supplies, or whose teachers belonged to a national association of biology teachers. (4) The lower rows of Table 10 show that public school teachers in rural schools—generally with a less adequate biological background than those in large and small cities—are relatively less well represented in both the teacher sample and in items C and D than are teachers in the cities. When these several facts and indications are considered it may be concluded that evidence obtained from this study indicates that the principle of evolution is now taught in notably less than half of the high schools of the United States.

It is further notable that in at least some cases where the teacher checked item D it is not clear whether he is teaching biology or theology. Thus a teacher in a rural public school (Ohio) supplements his check of this item with the comment: "Teach animal-human (evolution) plus divine creation." Large numbers of those who checked item F add the following statement or its equivalent: "Evolution as hypothesis, and point out lack of conflict with religion."

Reasons given for avoiding or lightly considering the subject of evolution. Table 11 provides significant information. A total of 916 teachers supplied one or more reasons for a total of 1,237 entries. It is perhaps significant that the "school administration" is regularly more often (97 to 56) credited with opposition to teaching the subject than is the "board of education." The reason most frequently given is, "opposed by a majority of the community" (287) and next by "my personal belief" (233). If "majority" and "minority" community opposition be combined they provide a total of 396. Only 73 acknowledge restraint "by action of our state legislature"; and it is notable that several teachers in several states wrongly think that their state (instead of their city?) has legislated against the teaching of evolution.

The group of 381 "other reasons" are of course most difficult to analyze or treat by means of figures or numbers. These replies nevertheless reveal so much of a condition which affects and restrains the teaching of secondary school biology that a group of 101 such replies (sometimes condensed) obtained from 11 states—which should be representative of the entire country—are given immediately below. It is notable that none of those (233) who had stated that teaching the subject is opposed by "my personal belief" is included in this printed list of replies. A recording of these replies will therefore make it evident to most readers that among the 381 who state "other reasons" are a considerable number who might properly be added to the 233 who checked the item for opposed by "my personal belief."

MAINE. *Public.* Town: "Do not stress due to religious groups." "Very little time for discussion." Rural: "No special reason except time."

NEW YORK (up-state only). *Public.* Large city (New York City omitted): "Recent work in genetics shows discrepancies in Darwin's theory." "Call evolution 'development'; when evolution is mentioned we face facts." Small city: "Only criticism has come from Catholics." "Not required in curriculum." Town: "I've had fights but haven't lost yet." "No conflict between evolution and religion." "Present as much as I can get away with." Rural: "Minister still objects but need not be taken seriously." "If openly taught as a fact would probably be strongly opposed by community." *Parochial.* "By scientific truth." "14 and 15-year-olds not capable of delving into philosophical reasoning so far

TABLE II

Those who avoided or lightly considered the subject of evolution gave the following reasons therefor

Region	Type of school	Number of replies	Teaching the subject is opposed by						Other reasons (written)	Total
			Board of education	School administration	Majority of the community	Minority of the community	Our state legislature	My personal belief		
Total U. S.	Public	843	56	77	266	104	70	208	345	1126
	Parochial	46	3	7	12	4		14	21	61
	Private	27	5	6	9	1	3	11	15	50
	Totals	916	64	90	287	109	73	233	381	1237
New England	Public	39	5	6	8	4	1	11	15	50
	Parochial									
	Private	4	1	1	1			2	2	7
Mid. Atlantic	Public	155	9	12	41	16	4	26	59	167
	Parochial	8			3			4	4	11
	Private	8	1	3	3		1	3	5	16
Southern	Public	184	19	21	58	14	52	38	47	249
	Parochial	13	1	2	4			2	4	13
	Private	2					1		1	2
Central	Public	361	19	30	126	55	9	123	164	526
	Parochial	20	1	4	4	4		8	9	30
	Private	12	3	2	5	1		5	7	23
Western	Public	104	4	8	33	15	4	10	60	134
	Parochial	5	1	1	1				4	7
	Private	1					1	1		2
Sp. large cities	Public	30	2	3	3	2	1	2	35	48
All large cities	Public	127	10	11	19	14	10	15	89	168
Small cities	Public	155	8	17	30	22	12	32	71	192
Towns	Public	225	14	24	77	24	19	41	80	279
Rural	Public	336	24	25	140	44	29	120	105	487

beyond them." "Subject taught thoroughly according to St. Thomas Aquinas (13th century)."

NORTH CAROLINA. *Public.* Large city: "Premature subject for age of 9th graders." Small city: "14-year-olds not sufficiently advanced to justify time required." Town: "One could stir up trouble here if he cared to; take evolution for granted and make no issue of it and get along." Rural: "Considered best to avoid." "If omitted would be due to pupil opposition." "Class time limited—text inadequate—taboo subject to most people." "Lack of opportunity for a clear thorough treatment." "I can see no reason for introducing it, besides it is a controversial subject."

FLORIDA. *Public.* Large city: "Religious groups." Rural: "Not essential for H. S. students to worry over." "Personal belief that hypothesis goes too far on facts known; certain cases of orthogenesis only do I accept." *Private.* "Evolution is not based on any fact or reason and Biblical account fits in with every natural law of science and nature."

WEST VIRGINIA. *Public.* Small city: "Taught as it arises with no special emphasis." "Not much said about it." Town: "Can teach what we like but do not think theory important enough to spend great deal of time on it." "Presented casually with definite proofs thru plants and animals." Rural: "Inability of students to grasp true significance." "Not entirely avoided but mentioned carefully because of possible misunderstanding."

WISCONSIN. *Public.* Large city: "No point in bringing up as controversial issue; structural progress is obvious and treated frankly and scientifically." Small city: "Who cares about evolution, my students don't; other topics are more important." "Taught as evolution, not as origin of species theory." "Teach evolution but never use word; community predominantly Catholic." "No definite opposition except occasionally from an individual." "Community highly religious." "Most H. S. sophomores cannot properly understand scope of theory; also many subjects of more interest and value to be taught." Town: "Polities." Rural: "90% Catholic community." "General educational and religious practice." "Not important in H. S.; time involved to explain can be used to better advantage." "Children trained in parochial schools immediately take issue if stressed and developed."

NEBRASKA. *Public.* Town: "Conflicts with religious groups which resent but do not openly oppose." Rural: "Content nature of text book." "If avoided, because teacher's place is not to break down what homes and churches have taught; besides only a theory not a fact." "I believe religious reasons." "Lack of time."

NORTH DAKOTA. *Public.* Small city: "Conflicts with religious belief of some families." Rural: "State requirements disregard it almost entirely; we follow state course of study." "We should take no stand in either direction." "By the bigoted ignorance of parents."

WASHINGTON. *Public.* Large city: "Children have not yet good scientific background." "Introduced as theory; not made dogmatic." "Believe too deep for H. S. students." Town: "Evolution meaning change—not from one-celled animal." Rural: "Pupils asked to speak to their ministers; not necessarily avoided." "Text does not stress and I see no reason to when there are other things more important to H. S. students." "Just a touchy subject in a rural community." "Because lack of definite information that man came from lower forms; evolution within species definitely considered." "Stress from theory standpoint but tell them scientists do not have proof and they can believe or not."

CALIFORNIA. *Public.* Large city: "Fundamentalist beliefs of majority of our students may not be attacked (negro and Mexican)." "I do not think subject should be allowed to disturb any religious belief of adolescents." "Since we are not responsible for how we were created but are responsible for what we become I think it does not merit much time in H. S." "Title 'evolution' avoided." "Fear of public reaction and lack of support of administrators." "Don't use word much; can't learn botany without learning about evolution." "If taught as hypothesis and not fact would be little opposition anywhere." "Controversial subjects are dynamite to teachers." Small city: "Seems relatively unimportant in helping individuals to live better." "To avoid argument and difficulty with a few parents." "Expected not to offend beliefs of students; do not refuse to discuss it." "Not much value to tenth grade students." "Scientists reasons given; own personal belief carefully guarded—no kick-back." "Mostly I believe in it but think time may be better spent on other phases at this grade level." "Little opposition in spite of Fundamentalists." Town: "See no reason in our situation to be particularly concerned with this subject." "Unimportant until more scientific 'facts' are produced." "Not avoided but misinterpreted by parents; biology opposes teachings of their churches." Rural: "Principal must kow-tow to all." "Enough biology can be taught without it."

"No reason for omitting or stressing." "Objected to but not opposed." "Don't believe in giving too much." "General religious attitude of the group." "More valuable topics to use the time." *Parochial.* "Theistic evolution is taught in religion classes as well as in science." "Seventh Day Adventists oppose evolution as unbiblical and unscientific."

Preliminary to a consideration of the distribution and implications of this comment we may proceed with our attempt to classify the 381 "other reasons" for avoiding or lightly considering the subject of evolution. Removing from this group the 53 duplicated checks with "opposed by my personal belief"—which probably accounts for their "avoidance" of the subject—there is a remainder of 328 whose comment (as reproduced above for 101 teachers) leads to the following classes of reasons for avoiding or lightly considering the subject of evolution: Religion—of community, pupils, teacher, school authorities, etc.—is either stated or rather clearly implied in 51% of these cases. "Not important," 11%. "Guardedly taught," 9%. "Pupils too young (or misconstrue ideas)," 8.5%. "Doubt truth or accuracy of evolution," 7%. "Too little time," 4%. "State (or city) course of study, 3.5%." "No conflict with religion," 2%. "Should not take sides," 2%. "To maintain position," 1%. Some of these latter items, *e.g.*, "guardedly taught," "pupils too young," "should not take sides," etc., are perhaps ultimately traceable to a religious background. Still others, *e.g.*, "not important," "too little time," "doubt truth of evolution," again point to the inadequate biological training of many who are asked to teach biology in our high schools. Even in these latter cases it might be difficult to absolve traditional religion from the attitude thus expressed by these teachers.

Disconcerting are the indications obtained here concerning the nature and the extent of limitations placed upon the teaching of the central and pervading principle of biological science. Like the contribution of Copernicus, Galileo, and Newton it is first of all an intellectual—a truly educational—liberator; but, in addition, the principle of organic evolution penetrates further and immediately into personal and social spheres. In an advanced country, late in the twentieth century, there is incongruity and shame in the fact that many educational doors are locked against its intellectual, its personal, and its social implications.

Summary

The amount of biological instruction "offered" in the high school curriculum varies widely in different states, regions and localities. In a small undeterminable percentage of schools a unit of biological science has been added to the curriculum during the past 10 years; 14.7% of teachers of this sample of public high schools report that a unit of biology has been dropped by their schools during the past 10 years, and a census of all schools of the country would probably show this loss in 10% of our high schools. It is doubtful whether gains to curricula are equal to the losses, and a net loss in the larger cities is evident. Substitution of a social study for a biological study—a movement led by large cities and doubtless still in progress—has lately occurred in about 10% of our schools. Approximately 19.8% of replies indicate that a biological subject—hygiene in 61% of cases—has been transferred to the teacher of physical education during the past 5 or 10 years.

Data concerning biology clubs suggest that biology teaching in all community types and regions is often effective in stimulating the interest of pupils. A consideration of the topics which teach-

ers would emphasize leads to the conclusion that, though many biology teachers teach soundly and effectively, there is a widespread tendency to teach biology not as science but (a) as a way to pleasing hobbies, or (b) as a series of practical technologies.

Genetic inequality of human beings is taught by 85.9% of public, 64.7% of parochial, and 87.1% of private school teachers who replied. Frequency of instruction in sex education varies widely in different geographical areas. The principle of organic evolution, seriously affected and restricted by the religious views of individuals and communities, is taught to one or another extent by about 50% of the teachers who replied to this questionnaire. The data indicate that complete returns from the schools of the United States would show that evolution is taught in notably less than half of the high schools. Even when "taught" this principle is frequently diluted beyond recognition, or it is so joined to traditional beliefs as to preclude a new ripple of thought.

The high school teacher of biology cannot alone resolve the many questions relating to his own adequate training, to his opportunity to teach an adequate amount of biology, and to his freedom to teach the foremost principles of his science. His principal and school administrators, his guides in professional and science training, perhaps his colleagues in other science subjects, must all find and contribute something that is essential to successful teaching of biology in the secondary schools of the United States.

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